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An Assessment of Environmental Problems Associated with Recycling of Hazardous Secondary Materials

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U.S. Environmental Protection Agency
Office of Resource Conservation and Recovery

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Staff members of the Recycling and Generator Branch, Office of Resource Conservation and Recovery, EPA Headquarters were responsible for providing objectives of this study, reviewing the methodology, helping to identify cases for further investigation, reviewing draft write-ups and drafting portions of the study. The EPA Work Assignment Manager was Amanda Kohler.

EPA was responsible for identifying potential cases, including those submitted through public comment as part of the Definition of Solid Waste Rulemaking process. The staff of ICF International was responsible for investigating potential cases, assembling relevant information, contacting persons with knowledge of selected cases, and drafting descriptions of each case.

An Assessment of Environmental Problems Associated with Recycling of Hazardous Secondary Materials

In January 2007, U.S. Environmental Protection Agency (EPA) published [[HYPERLINK "http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2002-0031-0355"](http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2002-0031-0355)] (also know as the “environmental problems study” or “study”). This study was conducted as part of EPA’s effort to revise the current “definition of solid waste” under the Resource Conservation and Recovery Act (RCRA), as it pertains to recycling of hazardous wastes and other hazardous secondary materials. In particular, the information in this study was compiled to assist the Agency in making decisions as to the scope and substance of these regulatory revisions. Since the study was published in 2007, EPA has continued to assess new reports of environmental problems associated with the recycling of hazardous secondary materials. A first [[HYPERLINK "http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2002-0031-0601"](http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2002-0031-0601)] was published in July 2008. A [[HYPERLINK "http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2010-0742-0006"](http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2010-0742-0006)] was published in June 2011.

This 2012 report is an update to the 2007 environmental problems study that combines all of the information compiled for the 2007 study, the 2008 and 2011 addenda, and new information collected by EPA since June 2011.

I. Background

In an October 28, 2003, Federal Register notice, EPA proposed to revise the definition of solid waste by excluding from regulation hazardous secondary materials that are “generated and reclaimed in a continuous process within the same industry” (68 FR 61558). That regulatory proposal resulted in more than two hundred comments being submitted to the Agency, from a wide range of stakeholders. In general, the commenters’ reactions to the proposal were less than favorable, for various reasons, and many commenters suggested alternative approaches to resolving issues associated with the current definition of solid waste.

A number of commenters to the 2003 proposal criticized the Agency specifically for not having conducted a thorough study of the potential impacts of these regulatory changes. These commenters expressed the general concern that de-regulating hazardous recyclable materials in the manner proposed could result in mismanagement of materials, and thus could create new cases of environmental damage that would require remedial action under federal or state authorities. Some of the commenters further cited a number of examples of environmental damage cases that were attributed to hazardous material recycling, including a number of sites listed on the Superfund National Priorities List (NPL) under the authority of the Comprehensive Environmental Response and Liability Act (CERCLA).

In deliberating as to how to proceed with the rulemaking proposed in October 2003, the Agency decided that additional data on recycling damage cases, as well as data on successful, environmentally beneficial recycling practices, would benefit the regulatory decision process, and would provide stakeholders with a clearer picture of the hazardous material recycling industry in this country. Accordingly, EPA chose to conduct these recycling studies, and consider their findings, before making decisions as to the appropriate direction for the

rulemaking. The 2007 environmental problems study was one of the recycling studies resulting from these efforts. It documented the findings of the Agency's study of environmental problems that have been associated with hazardous material recycling. These problems are documented by describing specific damage cases where health, environmental, or property damage resulted from recycling of hazardous secondary materials. A separate study entitled "An Assessment of Current Good Practices for Recycling of Hazardous Secondary Materials" documented current good practices for recycling of hazardous secondary materials. In addition, EPA produced a study of the economics of hazardous material recycling, entitled "Potential Effects of Market Forces on the Management of Hazardous Recyclable Materials." These three studies became part of the administrative record for the subsequent rulemaking effort.

Based in part on the three recycling studies, EPA issued a supplemental proposal in March 2007 to revise the definition of solid waste (72 FR 14172). This proposal led to the 2008 Definition of Solid Waste (DSW) final rule (73 FR 64668). In July 2011, EPA proposed revisions to the 2008 DSW rule intended to improve accountability and oversight of hazardous materials recycling, while allowing for flexibility to encourage hazardous secondary material recycling (76 FR 44094). EPA is issuing its final rule in December 2012.

Throughout the development and proposed revision of the DSW rule, EPA has continued to assess new reports of environmental damage cases associated with the recycling of hazardous secondary materials. Additional damage cases were documented by EPA in addenda to the 2007 environmental problems study published in July 2008 and June 2011. EPA has documented additional damage cases since June 2011. This report updates the 2007 environmental problems study by drawing all of the information compiled for the 2007 study, the 2008 and 2011 addenda, and new information collected by EPA since June 2011.

II. Scope of the Study

The general goal of the 2007 environmental problems study and its follow-up addenda has been to identify and characterize cases of environmental damage that have been attributed to some type of hazardous material recycling activity, and that are relevant for the purpose of the DSW rulemaking effort and subsequent revisions. Specifically, EPA sought to identify the following types of cases:

- *Cases where environmental damage can be attributed to some type of recycling activity.* One of EPA's objectives was to identify damage cases in which environmental damages were caused by some type of recycling-related activity. In this context, "recycling-related activities" included accumulation or storage of materials by the generator, the recycler or an intermediary, illegal disposal or abandonment of recyclable materials or recycling residuals, transportation of recyclable materials, "sham" recycling operations (i.e., illegal disposal or treatment disguised as recycling), production and/or use of contaminated products from recycled materials, reclamation and/or production processes, management of residuals from reclamation or production processes, or other activities associated with the management of recyclable materials, recycling residuals, or the products of recycling processes.

EPA did identify a number of cleanup sites at which a recycling process had operated, but where other sources of contamination made it extremely difficult to determine with any certainty that the recycling activity contributed to the environmental problems at the site. These cases were not included in the damage cases summarized by EPA.

- *Relatively recent cases.* Many of the damage cases EPA examined for this study occurred before RCRA, CERCLA, or other environmental programs were established in the early 1980s. As a number of commenters on the 2003 proposed rule noted, these environmental programs – most notably, the liability provisions of CERCLA – have created strong incentives for proper management of recyclable materials and recycling residuals. Several commenters further noted that because of these developments, industrial recycling practices have changed substantially since the early 1980s, and present day generators and recyclers are much better environmental stewards than in the pre-RCRA/CERCLA era. Thus, they argue, “historical” recycling-related damage cases are not particularly relevant or instructive with regard to modifying the current RCRA regulations for hazardous material recycling. EPA generally agrees with this viewpoint, in part because the 2007 companion study of current good hazardous material recycling practices documented that responsible generators and recyclers do make considerable efforts to ensure that materials are recycled and otherwise managed in a safe, environmentally protective manner.

In the course of researching hazardous materials recycling damages, it became apparent that while the CERCLA statute and the initial RCRA hazardous waste regulations became effective in 1980, there was an initial “phase in” period during which industry and other affected entities began to change their practices with regard to hazardous material recycling, and during which federal and state agencies were developing guidelines and procedures for implementing these new authorities. Perhaps not surprisingly, EPA identified a number of recycling damage cases that occurred during the early 1980s that appeared to have been caused by companies and individuals who were not cognizant of their new responsibilities and potential liabilities under RCRA and CERCLA. Because EPA believes that recycling damage cases that have occurred within the current environmental regulatory and liability systems are most relevant to the definition of solid waste rulemaking effort, the damage cases documented by EPA are only those in which some form of environmental damage appears to have occurred during or after the year 1982. We did not however, exclude cases where damages occurred both before and after 1982.

- *Cases involving recycling of regulated hazardous wastes, or hazardous secondary materials that are specifically excluded from RCRA regulation.* EPA’s research was intended to identify damage cases associated with recycling of regulated hazardous wastes, as well as cases involving recycling of hazardous materials that are not regulated because they are subject to a specific regulatory exemption or exclusion (see, for example, the exclusions in 40 CFR 261.4). EPA is interested in these types of damage cases because they may indicate the extent to which environmental damages can occur even when recycling is conducted under a stringent regulatory regime, and whether such damages may be more or less prevalent for materials that are explicitly exempted or excluded from RCRA regulatory controls. The scope of damage cases does not include cases involving recycling of non-hazardous materials such as paper, glass, rubber or plastics.

III. Methodology

The initial task of the 2007 environmental problems study, as well as the follow-up addenda, was to identify recycling-related environmental damage cases that were relevant to the scope and purpose of the study (the types of cases that were considered relevant are described in Section II). Potential cases were identified from a variety of sources, including:

- Comments on the October 28, 2003, 2007, and 2011 proposed rules
- The Superfund National Priorities List
- National EPA data bases maintained for the CERCLA, RCRA and enforcement programs
- Contacts with staff in state environmental agencies
- Contacts with staff in EPA Regional Offices
- State agency data bases maintained for state superfund programs and other environmental programs
- Internet searches
- News media reports

It should be noted that because of time and resource limitations, the searches for potentially relevant damage cases were not exhaustive. For example, we did not systematically survey all state environmental agencies for relevant cases, nor did we search paper files in EPA Regional Offices. Because of these limitations, we believe that the cases we have identified and described to date in effect represent the cases that were relatively easy to find, and that there may be additional relevant cases that we did not identify.

Once a potentially relevant damage case was identified, EPA's contractor assembled relevant information to determine whether or not the case fit within the scope of the study. If the damage case was considered a likely candidate for the study, further information was gathered with the intent of identifying certain key facts about the case that the Agency believed would be particularly informative for the purpose of this rulemaking. These key facts included:

- Name, location and EPA Identification Number (if available) of the site
- Types of materials that were recycled, or intended to be recycled
- The government program responsible for overseeing the cleanup of the site, and whether or not the site is or was listed on the Superfund National Priorities List (NPL)
- Brief description of the site
- Basic site history, including when the recycling occurred, and when the environmental damage occurred
- Basic description of the recycling process
- The type(s) of environmental damage that occurred
- The types of activities or circumstances that caused the environmental damage
- Whether or not human health impacts, including deaths, were associated with the damage
- Whether or not those responsible for the environmental or human health impacts were prosecuted for criminal violations
- Whether the materials were recycled on-site (i.e., at the generating facility) or at an off-site recycling facility
- Whether or not the recycler went bankrupt or otherwise went out of business
- Whether or not the recycling facility had a RCRA Part B permit for managing hazardous wastes¹

¹ Note that RCRA Part B permits are not required for hazardous waste recycling processes or operations themselves; in general, Part B permits are issued, as applicable, for storage of hazardous wastes prior to recycling.

- Cost of cleaning up the site
- Other information that could help identify why the environmental damage occurred

Many of the cases that were investigated were well documented, and we were able to assemble virtually all of this information. This was the case, for example, for many of the Superfund NPL sites. However, in many other cases it was not possible given the limitations of the study to document all of these facts. Often, there was considerable technical information as to the nature and extent of the contamination at the site, but relatively little information regarding the activities and circumstances that originally caused it. For some of the sites, we were able to collect only very basic information.

Drawing together findings of the 2007 environmental problems study, the 2008 and 2011 addenda, and new damage cases identified since June 2011, EPA has identified 250 damage cases associated with hazardous materials recycling. For each of these damage cases, EPA's contractor prepared a written description. Appendix 1 of this report contains each of the 250 damage case descriptions organized alphabetically by site name. An index of the damage cases sorted by state is provided in Appendix 2. Appendix 3 is a listing of the damage cases that were reviewed but were not investigated in detail, either because they did not fit within the scope of the study, or because there was insufficient information to make that determination.

IV. Summary of Findings

This study identified 250 cases in which environmental damage of some kind occurred from some type of recycling activity, and that appeared to clearly fit within the scope of the study, as described above. In this context, we used the term "environmental damage" broadly, to include human health, environmental, or property damage resulting from leaks, spills, dumps or other types of releases of hazardous substances into the environment that were serious enough to require some type of cleanup action. It also includes situations in which materials were abandoned (e.g., in warehouses) without having been actually released into the environment, but which posed potential threats and thus required removal actions that were conducted by one or more government agencies, and involved expenditure of public funds.

We did not include damage cases in which environmental regulatory violations occurred, but did not result in actual damage to the environment or to human health. For example, we found a number of cases where recycling facilities had been subject to enforcement actions for RCRA regulatory violations (e.g., inaccurately completed manifests), but where there did not appear to have been any releases to the environment that required cleanup. These types of cases were not included in the 250 damage case profiles, though they are identified in Appendix 3 to this report.

Types of Recyclable Materials

Figure 1 presents the types of materials that were recycled (or were expected to be recycled) at the sites where environmental damage occurred. Note that sites may be counted more than once in these results since, in many cases, more than one type of material was recycled at the site. Scrap metal was reported at 62 (25%) of the sites, making it the most common material type. Other frequently reported material types included batteries at 43 sites (17%), spent solvents at 42 sites (17%), used oil at 41 sites (16%), other metal-bearing wastes at 38 sites (15%) and drums at 25 sites (10%).

Figure 1: Recycled Materials*

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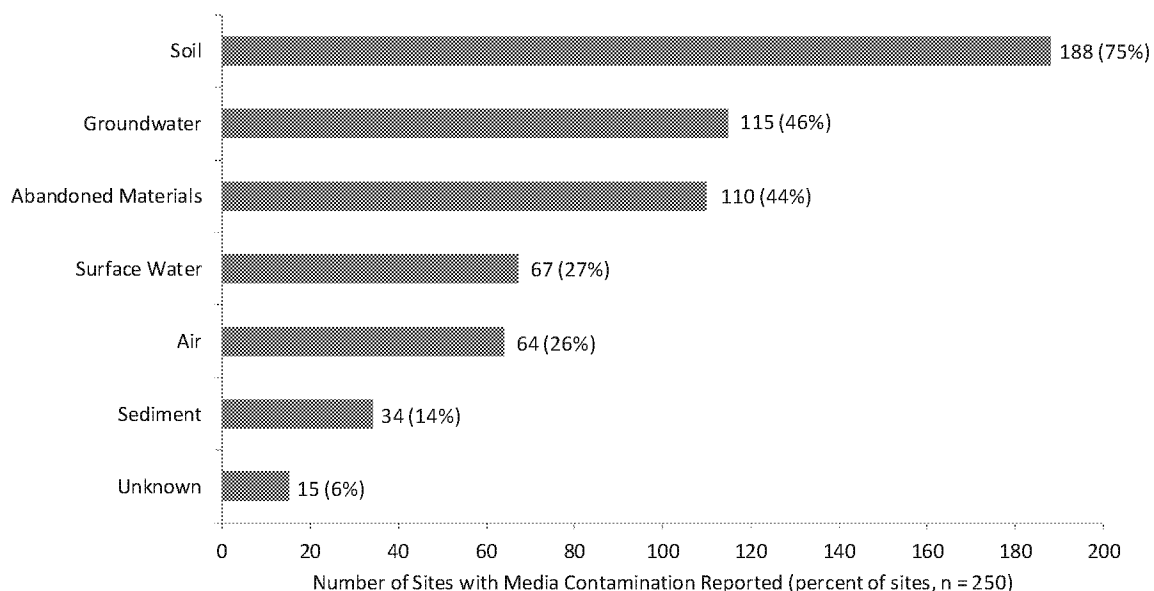
Types of Environmental Damage

Figure 2 summarizes the types of damages to environmental media that were found to have occurred at the recycling sites that were investigated. Note that sites may be counted more than once in these results, since in many cases more than one type of damage occurred. Also, note that Figure 2 does not include property damages or human fatalities or injuries. On average, there were about 2.4 types of media contamination per site. Soil contamination occurred at 188 sites (75%), making it the most common type. Groundwater contamination and abandoned materials (e.g., uncontained waste piles) were present at 115 and 110 sites (46% and 44%), respectively. Contamination to surface water was present at 67 sites (27%), and air contamination (e.g., from fires) was present at 64 sites (26%). Sediment contamination was present at 34 sites (14%).

Damage Causes

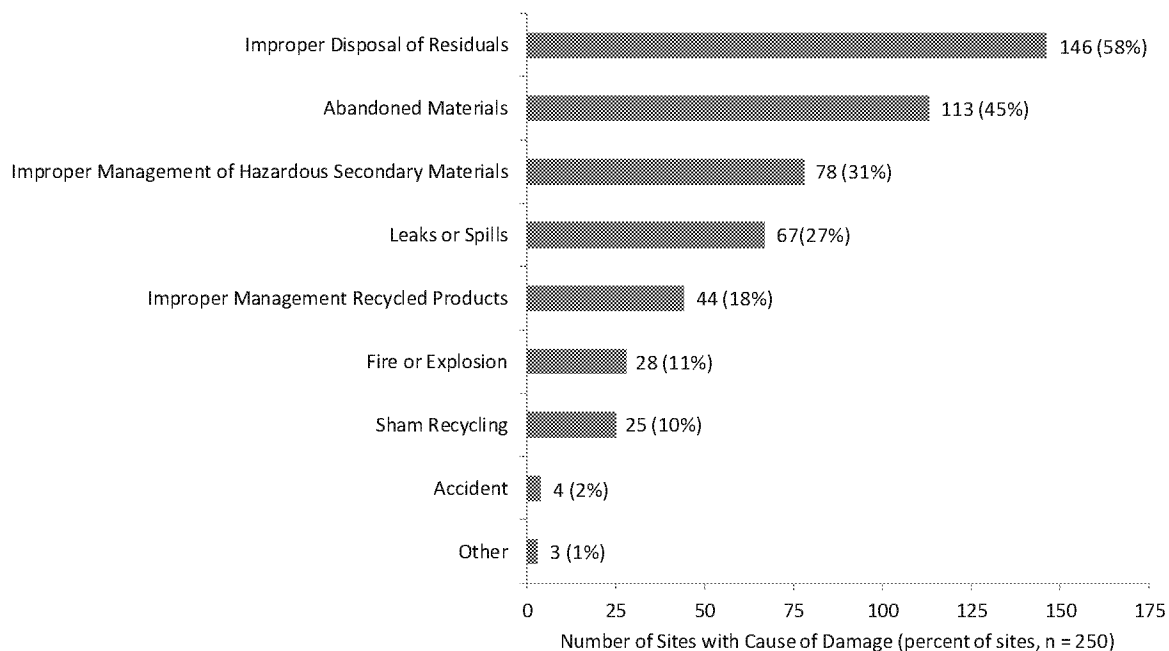
While the analysis did not attempt to probe in great detail the exact actions or circumstances that led to contamination problems at these sites, in most cases we were able to identify in general terms the primary cause of the contamination. These primary causes, and the number of cases attributable to them, are presented in Figure 3. Damage case sites may be counted more than once in Figure 3 because more than one cause may contribute to damage at the site. On average, about two causes were identified per site.

Figure 2: Type of Damage*



*For many damage cases, there was more than one type of contaminated media. Therefore, damage cases may be counted more than once in this figure.

Figure 3: Causes of Environmental Damage



*At many sites, there was more than one type of contaminated media. Therefore, sites may be counted more than once in this figure.

The most prevalent cause of environmental damage was improper disposal of residuals, which was reported at 58% of the sites. At many of these sites, reclamation processes generated residuals in which the toxic components of the recycled materials became concentrated, and these wastes were then mismanaged. For example, these sites included a number of drum reconditioning facilities, where large numbers of used drums were cleaned out to remove small amounts of remaining product such as solvent, and these wastes were then improperly stored or disposed. Improper management of recyclable hazardous secondary materials and improper management of recycled products were reported causes at 31% and 18% of the sites, respectively. Of the 250 damage cases, 113 cases (45%) involved abandoned materials. The relatively high incidence of abandoned materials likely reflects the fact that bankruptcies or other types of business failures were associated with at least 48 (19%) of the cases. Taken together, leaks, spills, fires, explosions, or other accidents caused environmental damage at 19% of the sites. Sham recycling is believed to have occurred in 25 cases (10%).

On-Site vs. Off-Site Recycling

One of the questions we wanted to examine in this study was whether or not there may be any significant differences in the frequency, type or causes of environmental damages with regard to recycling that is conducted on-site (i.e., at the facility that generated the recyclable secondary materials), as compared to off-site, commercial recyclers.

Of the 250 damage cases documented in this report, 229 (92%) involved facilities that received waste from off-site for recycling. At 12 sites (5%), damages involved on-site recycling by the generator, and at two sites 2 (<1%) damages occurred at generating facilities where wastes

were to be transferred off-site for recycling. At 7 sites (3%), damages involved intermediate facilities where wastes from off-site generators were aggregated for planned recycling off-site. The small number of on-site recycling damage cases may indicate that this type of recycling is inherently less environmentally risky than recycling at off-site commercial facilities. However, it may also be that on-site recycling is simply a less common practice, or that these types of damage cases are less well documented, and thus more difficult to identify than cases involving commercial recyclers. In any case, it should be noted that several of the on-site damage cases, including Standard Chlorine of Delaware and the Monsanto P4 facility, were apparently among the most expensive cleanup sites that we documented.

Regulatory Status

Another issue we were interested in assessing as part of this study was the number of damage cases that occurred at facilities that, at one time or another, were operating under RCRA Part B permits. RCRA permitted hazardous waste management facilities are subject to relatively stringent, facility-specific requirements, and in general are given more oversight by regulatory agencies than facilities without permits. For these reasons, these cases are of particular interest to the Agency with regard to the regulatory initiative. The regulatory status was unknown for 2 (<1%) of the facilities. Among the facilities where the status was identified, 51 facilities (20%) were operating under RCRA Part B permits. 197 facilities (79%) where damage cases occurred were not RCRA permitted.

Additional Information

Further information is available in the attached appendices. Appendix 1 contains each of the 250 damage cases summaries sorted in alphabetical order by site name. The damage case summaries have a generally consistent format. However, because many of them are reproduced from previous reports (e.g., the 2007 environmental problems study) the formatting and other details may vary.

For readers who would like to identify damage cases in a particular state, Appendix 2 is a listing of the damaged cases sorted by state and site name. Appendix 3 is a listing of the damage cases that were reviewed but were not investigated in detail, either because they did not fit within the scope of the study, or because there was insufficient information to make that determination.